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‘We can only request what’s in our protocol’: technology and work autonomy in healthcare

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Abstract

This paper explores the tension between standardization and autonomy raised by the implementation of new technology in healthcare organisations. The theoretical frame of this study is grounded in the impact of new technologies on work organisation, routinization and autonomy across settings. Empirically it presents evidence from two NHS Trusts in England that implemented a national Electronic Patient Record (EPR). The paper aims to reinvigorate the debate on the tension between standardization and autonomy in professional workplaces such as healthcare. It argues that the implication of technology in professional work conditions processes of task routinization that constrain autonomy, and enables reallocation of discretion between professional groups. We argue that routinization is not restricted to low-skill work but may travel across contexts and be evidenced in high-skill work environments. The interplay between routinization and autonomy is also useful in drawing insights concerning the dynamics of change that occur in professional work.

Keywords: autonomy, healthcare, professionals, technology, standardization, discretion

Introduction

In the past decades the National Health Service (NHS) in England has been subject to successive reforms, designed to 'modernize' the way healthcare services are provided. These reforms and their implications for work have been studied from a range of perspectives. There is a stable body of literature that examines the implications of institutional reforms for work organization and practices, including the reorganisation of work roles between healthcare professionals (Bach et al., 2008; Bach et al., 2012) and the introduction of work flexibilities (Desombre et al., 2006; Grimshaw, 2000; Leverement et al., 1998). This strand of literature tends to largely ignore the role of technology in reshaping work organisation in healthcare.

Another strand of literature has looked at the process of implementation of various information technology (IT) solutions in healthcare, including: Electronic Patient Records (EPR) (Halford et al., 2010; Davidson & Chiasson, 2005; Greenhalgh et al., 2009; Oborn et al., 2011), enterprise resource planning systems (Boonstra & Govers, 2009), electronic prescriptions (Boonstra et al., 2004; Motulsky et al., 2011) and call-centres (Mueller et al., 2008). Although these studies often examined the boundaries between inter-professional roles, values and the contested process of change, little attention has been paid to the implications of technology for work autonomy and task discretion in healthcare organisations (Barrett et al., 2011; Petrakaki et al., 2016).

The present study seeks to address this gap by examining the impact of new EPR on work standardization, autonomy and discretion. We report evidence from two case studies of NHS Trusts that implemented a national EPR, the National Care Record

Service, part of the National Programme for Information Technology (NPfIT) in the NHS in England (Sheikh et al., 2011). The NPfIT aimed to streamline healthcare organisations and the delivery of care, but was deemed to fail to meet its targets and realise its anticipated benefits (National Audit Office, 2011). It was thus dismantled in 2011. Although it has been a defunct programme it presents us with rich historical material concerning processes of standardization of work conditioned by the introduction of technology in healthcare that are applicable more widely beyond the particular programme, context or time span.

The overall aim of the paper is to further our understanding of the tension between standardization and task discretion that is raised by the implementation of new IT solutions in a context of high-skilled professional workplace, such as healthcare. In this paper we assume that routinization of work is a potential outcome of standardization and that autonomy is, among other things, the ability to exercise discretion.

One of the contributions of this paper is the synthesis of insights from scholarly works that have examined standardization of work in low-skilled environments. By drawing a comparison with the literature on routinization of work in call-centres, we attempt to challenge how professional autonomy and medical rationality are taken for granted in healthcare settings. Our paper seeks to reinvigorate the debate on the tension between standardization and autonomy. To this end, we contend that the concept of routinization of work may travel across contexts and is useful for drawing insights and understanding the dynamics of change even in highly-skilled professional groups such as doctors and nurses.

The remainder of the paper is structured as follows. The first section reviews the theoretical frame of this study, which is grounded in the impact of new technologies on work organisation, looking more specifically into the dynamics between standardization and autonomy in different organisational contexts. The second section elaborates on the research design and methodology of this study. The third section presents the two case studies and charts the interplay between standardization and autonomy in the workload of healthcare professionals. The final section discusses the findings and provides conclusions.

Between routinization and professional autonomy: Technology in healthcare

Several scholarly works have contemplated the transformative impact of technology on work (Adler, 1992; Boreham et al., 2008; Hyman & Streeck, 1988; Zuboff, 1988). There is an on-going debate as to whether the introduction of new technology leads to job enrichment and upskilling/re-skilling or routinization and deskilling (Munro & Rainbird, 2002, p.234; Zuboff, 1988). Such dichotomous conceptualisations may conceal the variety of workers' experiences in different organisational forms such as public-private partnerships with networks of subcontracting and IT vendors and suppliers (Grimshaw et al., 2010, p.419). Functional flexibility is key as regards employees' ability to be deployed to match the tasks required by changing technology (Procter, 2006). But it is equally plausible that job enlargement may also lead to widespread work intensification and functional flexibility may be perceived as 'management by stress' (Legge, 1998).

The potential impact of technology on workers' task discretion and autonomy is a question that has been addressed in different organisational contexts. In the extensively studied call-centre sector, there is ample evidence that shows how the use of technology leads to Taylorization of work organization in white collar office settings (Bain et al., 2002). In many instances, work organization change in call centres followed a 'routinization path' entailing low levels of task discretion, tightly scripted dialogues and highly repetitive tasks with short task cycle times (Taylor & Bain, 2001, p.45; Taylor et al., 2002, p.136). Routinization circumscribed the work autonomy of call centre operators to a significant degree with little opportunities for resistance beyond individualized escape routes (Knights & McCabe, 1998). IT enforces standardization even further. Taylor & Bain (2007) have shown how software such as Blue Pumpkin, is used in call centres to provide minuted control over staff 'measuring outputs and monitoring adherence'. However, there are different ways in which technology may be used as a form of managerial control and monitoring and this may also depend on the organizations' overall strategy focused on quality or price as well as the context the call-centres' clients operate (Grimshaw et al., 2002, pp.200–201).

Hence, the tension between standardization and quality of service delivery may temper the degree of routinization. This can be shown more vividly, once we conceptualise call-centre work as a form of 'emotional labour' (Taylor & Bain, 2001, p.41). In this case, call-centre workers may be required to show 'empathy' thus suggesting higher levels of discretion (Taylor et al., 2002, p.135). When managers focused on quality assessments, their interest was to assess the 'enthusiasm', 'helpfulness' and 'tone' (Taylor et al., 2002, p.137) that contributed to customer

satisfaction and quality of service delivery. This draws a parallel with the 'emotion work' required in the medical profession towards patients. Still it does not alter the perception of call-centre work as a 'low-skill' or 'semi-skilled' occupation, particularly in terms of formal qualifications and the level of training that is required. Our interest in this paper is to show how a routinization process can be equally applicable in the more 'high-skill' occupation of healthcare professionals.

Some commentators argue that in professional settings such as healthcare the scope for routinization may be limited for two main reasons. First, a key element of healthcare professional identity is the invocation of a discourse that revolves around the values of safety and patient-centred care (Mueller et al., 2008, p.5). These values are not typically associated with standardized work tasks. Second, unlike the perspective of technology that may lead to deskilling and fragmentation of work (Munro & Rainbird, 2002, p.225), technology may confer expertise or technical specialisation that brings control over narrower but also more esoteric knowledge, which usually enhances autonomy and control (Barley, 2009).

The adherence to professional values and the highly technical expertise and esoteric knowledge suggest that any attempt to circumscribe healthcare professional discretion through the introduction of technology may be met with some form of resistance. This opens up the possibility for healthcare professionals to uphold their professional values and 'work around' technological innovations or reject them altogether, in order to avoid suppressing their autonomy and discretion. Studies of healthcare organisations that introduced computer systems which were deemed as 'surveillance-capable' suggest that nurses were able to circumvent the surveillance capability of the

systems (Timmons, 2003, p.151). Indeed, Berg (1997) has argued that technologies intended to routinize clinical work, such as decision support tools, are 'doomed to fail' as they neglect the complex context within which healthcare professionals work (Berg, 1997, p.7).

Nonetheless, technological innovations always entail the prospect of standardization. At a more abstract level, assumptions designers have for instance about the user, about the users' roles, needs and preferences and about the way in which users collaborate and interact are 'inscribed' into the technology to such as an extent that we could actually think of technology as being a script or a scenario (Akrich, 1994, p.208). To tailor technology users would then need then to 'read' technology and articulate their work so as to modify technology accordingly (Suchman, 2002). Along similar lines Grint & Woolgar (1997) argued that the user is configured by the technology in the sense that technology already bears assumptions about who the user is. Winner (1999) has gone even further to assume that technology is inscribed with politics, designed as it is to be used by a specific type of user, excluding all other potential ways of being a user. Designers' assumptions constitute the 'embodied standards' of technology that cannot always be negotiated post-implementation (Kallinikos, 2010). In fact inscriptions are likely to constrain (albeit not eradicate) the autonomy of those who interact with technology as part of their work process.

This can be further fleshed out empirically when we examine the case of electronic records and healthcare professionals. The latter may perceive universal guidelines as being rigid, restricting the use of their professional judgment (Boonstra et al., 2004). This signifies limited autonomy and discretion and 'working around' the system

might not always be possible. For instance, moving from paper-based to electronic medical records will typically standardize the categories, the sequencing of tasks, and determine narrowly the workload of clinicians whilst allowing managers to monitor 'what work there is, who has performed/should do what and when' (Halford et al., 2010, p.212). Yet, the implications of technology for work autonomy are not unidirectional and neither are they deterministic. The introduction of technology in work organisation provides opportunities for more or less autonomy, and seems to redistribute the ability to exercise discretion both within and across healthcare professional groups. The question therefore should not be about whether or not there is resistance to technology but rather how technology is being resisted. As Timmermans and Berg (1997) have suggested we should explore how technological mediations are being negotiated, appropriated and produced anew in health contexts and beyond looking into local forms of standardization or what they called as 'local universality'. Vikkelsø (2005) also suggested that we should move away from a perspective of improvement, according to which technology is assessed on the basis of the efficiencies and improvements it provides to professionals towards a perspective of distribution whereby the introduction of technology such as an EPR is assessed according to the changes it brings about in the '*distribution of work, responsibilities, capabilities, attention and risks*' (Vikkelsø, 2005, p.23). These changes offer opportunities to either increase autonomy or limit autonomy or both. For instance, following the introduction of an EPR in a Danish hospital nurses became more informed about clinical decisions, which were electronic and thus visible, but at the same time they became responsible for inputting information, which they would previously only report orally (Vikkelsø, 2005). Studies have also shown how the introduction of technology in healthcare redistributes autonomy between different

healthcare professional groups that work together (Badham, 2009; Barrett et al., 2011). For example, Barley's (1986) classic study of CT scanners indicated how technology disrupted work organisation and rearranged task domains and discretion between Radiologists and Radiology technologists.

Finally, we should also consider that the ways in which standardization plays out with autonomy in work organisations open up a field whereby different rationalities and discourses are contested more visibly. Studies have shown for instance, that a managerial rationality may encourage standardization and control; a technical rationality may focus on the design and development of the 'right' technology whereas a professional rationality will typically fall back on its focus on quality of care and patient safety (Boonstra & Govers, 2009; Leverement et al., 1998; Mueller et al., 2008). It is typical for health professionals as well as hospital managers to make reference to these rationalities in order to justify their decisions or actions to implement, enforce or resist technology and its attempts to standardization. Indeed in the following sections we show how healthcare professionals in the NHS reacted to attempts attaining to standardization of their work by invoking frequently the discourse/rationality of patient care. Before we do so we present in the next section our research design and methods.

Research Design

The Context of the study

The National Programme for Information Technology (NPfIT) within the NHS in England provides the macro-institutional context for our study. The programme started under the UK Labour government in 2002 and -at the time of its inception-

was the largest non-military information technology project ever to be undertaken globally (Brennan, 2005). The NPfIT embraced the vision of transforming the NHS in several ways including *inter alia*: its clinical and administrative work practices, decision making processes, delivery of healthcare, and sharing of information.

In this paper we focus on two Acute Trusts in the NHS that were early adopters of one of the pillars of the NPfIT, the NHS Care Records Service (henceforth: CRS), which was the national electronic patient record. This study is a part of a larger study that examined the implementation of the NHS CRS in 12 Trusts in England (Klecun et al., 2014; Sheikh et al., 2011). To maintain anonymity and confidentiality, the two Trusts are referred here as NorthTrust and SouthTrust. The two Trusts were implementing different CRS systems, the AlphaSoft and BetaSoft, and a different supplier, AlphaCo and BetaCo, provided each system respectively. GammaCo was the Local Service Provider (LSP) installing BetaSoft in SouthTrust, whereas DeltaCo was the Local Service Provider, installing AlphaSoft in NorthTrust. It is important to highlight that none of the Trusts selected the system they were implementing but each Trust implemented the software that was offered in their region. The Department of Health contracted different software houses to provide CRS systems so as to avoid dependence on one supplier only. Trusts were contacted as early adopters to participate in the implementation of CRS systems but they were not party to these contracts (Robertson et al., 2010; Sheikh et al., 2011).

NorthTrust participated in the NPfIT since 2004. It expected that its participation in the NPfIT would be a trigger to streamline business processes and use of information systems. It was anticipated that the programme would assist in the delivery of 'joined-

up' clinical processes within the Trust as well as across other healthcare organisations; would catalyse the elimination of silos; would reduce paper usage through digitalisation of business processes. NorthTrust was selected as an early adopter of the first release of *AlphaSoft.* The adoption of AlphaSoft in NorthTrust started in January 2008 and went live in March 2009 in the Radiology and Orthopaedic departments for ordering requests and reporting results for postoperative hip and knee joint replacements, for outpatients and elective inpatient cases. It was initially implemented in two clinics before being expanded to two other wards and other departments by June 2010. The NorthTrust implemented the CRS system slowly so that it could be tailored to their needs and to the English NHS work setting. AlphaSoft was developed according to the requirements of the hospitals; it was not an off-the-shelf product (Cresswell et al., 2011). The implementation of AlphaSoft was abandoned after the dismantling of the NPfIT.

SouthTrust implemented a first release of the BetaSoft in March 2007. The Trust anticipated a number of benefits arising from the adoption of the NHS CRS such as improved patient safety by having the right information, in the right time and the right place; better quality of care by reducing data duplication and manual data entry and improved clinical decision making by providing clinicians with up-to-date information. In contrast to NorthTrust, the SouthTrust implemented the BetaSoft across all its departments within a single day in a 'big bang' approach. BetaSoft was developed in the US successfully and was transferred to the English NHS. The first Trusts that implemented BetaSoft, including SouthTrust, had limited choice to tailor it to their needs (Cresswell et al., 2011). The system offered basic clinical functionality and the Trust was considered an early adopter. 18 months after the NCRS

implementation the Trust opted out of BetaSoft and reverted to an upgraded version of the system it was using prior to the implementation of BetaSoft.

Our research design follows the comparative case study method (Yin, 2003). The case selection criteria include a common impetus for IT-enabled organisational change in the form of the umbrella NPfIT programme. As mentioned above the two NHS Trusts were implementing different NCRS systems offered by different suppliers. The cases also vary in the outcomes of implementation of this new IT system, as defined by participants themselves. In NorthTrust the implementation process was successful at a small-scale and the Trust planned to expand the rollout to other Departments, before the NPfIT was dismantled. By contrast, the SouthTrust prepared for the implementation of the new care system very enthusiastically, rolled it out, and finally decided to opt out of the NPfIT programme, before the latter was shut down.

Research methods

The information collected for the case studies have been gathered through semi-structured interviews and relevant documents. Interviews were conducted between May 2009 and December 2010 before and after implementation of the new IT systems. The empirical section relies on 29 interviews in total with key informants in both Trusts, including different professional groups. These included: healthcare professionals (e.g. clinical leads, consultants, nurses, matron, etc.), managers (e.g. director for patient records, programme manager) and members of the technical team (IT technicians, IT managers). The majority of the interviews were conducted in person; they were recorded following oral informed consent, lasted about an hour each and were transcribed verbatim. The NHS Research Ethics Committee classified

the larger study as a Service Evaluation. We sought approval by each of the two Acute Trusts following research governance procedures that were in place in each of the two sites.

Data collection was supplemented by a range of primary documents, which enriched our understanding of the context under investigation as they embedded the intended rationale that surrounded the adoption of the NHS CRS in both Trusts. Documentary evidence included: newspaper articles, minutes from project meetings, information provided by each Trust's web site, 'lessons learned' reports, project initiation documents and risk registers. Documents were carefully read and notes were kept. Data analysis was an iterative and longitudinal process. Interview transcripts were continuously read and out of them broad themes emerged. We identified themes according to their relevance with the literature we reviewed and the scope of our study. Themes were refined and merged when needed as the analysis was progressing and interpretations started being developed. Some of these themes include: standardization of work, electronic monitoring of work, doctor-patient relationship, working across professional boundaries; task discretion, and autonomy. We would also seek to assess the validity of contradictions in the collected information through triangulation (interviews, primary, and secondary documents). Generally however contradictions found in the collected information were seen as opportunities to enrich our analysis by bringing to the fore additional perspectives.

Technology and work autonomy in healthcare: the cases of two NHS trusts

In this section we examine the cases studies of two NHS trusts. In each case we provide a brief background of the profile of the Trust and the motivation of different stakeholders to implement a CRS system. The narrative of the cases focuses on the organisational change process and final outcomes, paying particular attention to the discourse of different stakeholders with regard to key themes: standardization, task discretion and autonomy.

Standardization, task discretion and autonomy in NorthTrust

The fieldwork in NorthTrust revealed that different stakeholders had different perspectives on the NHS CRS and its purpose. The NHS CRS has been described by some as being a means for monitoring the outputs of Trusts and healthcare professionals. Through the implementation of the CRS systems the Department of Health could generate aggregated information about various performance indicators such as costs, outputs or performance profiles of each Trust. Centralised information could then be used as a way to compare the results and performance of healthcare organisations and as a basis to make decisions on future resource allocation. According to the project manager, such comparisons engendered financial risk and raised fears of job insecurity:

> '…by nature, the National Programme is going to be restrictive. It's going to implement standardization… It might give you some transparencies. It might give you some aggregated understanding. You might find that one hospital cost profiles are completely different to another. You might start to look at why and people might be nervous of their jobs, even.' (Programme Manager).

In addition, the programme manager defined the NHS CRS as a way to change the way work is organised in the NHS. Specifically, the programme was perceived as being a way to eliminate differentiation of work practices among specialties and wards, to standardize the process of healthcare delivery and the conduct of healthcare professionals and to regulate the way in which healthcare professionals interact with patients:

> '…their ideal is that the NHS will become standardized, so the way in which we interact with computers and the way in which we interact with patients will become standardized' (Programme Manager).

Despite its small-scale implementation, AlphaSoft brought about several changes in the workload of healthcare professionals in NorthTrust. In particular, AlphaSoft computerised some doctors' tasks by allowing them to write and dispatch X-ray requests though the system. Nurses previously carried out this activity and doctors simply signed the requests. Further, the system pre-populated data, for instance patients' demographic information and medical history with the aim to speed-up and standardize the requesting process. In this way, it prescribed what information each healthcare professional group should seek. Despite this, the process was slower in comparison to manual completion, taking approximately five to six minutes longer. More importantly, unless properly checked, pre-populated data could include various errors. For instance, if the patient had changed their general practitioner (GP) or the GP had moved then a part of the patients' demographic data fields would be inaccurate. This is due to a lack of synchronisation and communication between GP and hospital systems.

Also, the new system increased the workload of clinicians in the Orthopaedic department, because it compelled them to complete mandatory fields that were not deemed necessary on paper requests. In doing so, it also took away some of their discretion for the completion of requests. Specifically, under the paper system Orthopaedists were responsible for checking whether a woman is pregnant or not before placing an X-ray request. Clinicians would do this by observing or asking the patient and then they would write it down as a note. AlphaSoft standardized this process. If a female patient's age was within the child bearing age -these limits were predefined by the system- then Orthopaedists were obliged to fill in the field on the request form. In the past Orthopaedists could skip this question, transferring the responsibility for completing the field to Radiologists. This confirmed a nurse's viewpoint that the system framed and standardized their requesting behaviour. Standardization of requesting behaviour came from the fact that electronic forms had been mapped against the protocol and as a result clinicians needed to complete it in full in order to get it through the system:

> 'Now the system's been set up so that we can only request what's in our protocol, so you can't make mistakes on it…'. (Nurse)

> '…there are lots of mandatory fields on the request cards, which will have to be filled in otherwise the request will be bounced electronically and we won't even see it and it would drive the clinicians mad…' (Radiologist)

For Orthopaedists and also for other healthcare professionals, the intervention of technology in their practices and the changes that this entails was perceived as being a

criticism of what they currently did and an attempt to curtail their autonomy by imposing a standardized way of working:

> '... It's that fact that that group of clinicians would need to change the way they do it for the greater good. So if you like, it's a threat to their autonomy and it's the threat to the way they've done it before. It's almost like a criticism. We want you to change because we want you to conform because what you are doing is not best practice.' (Orthopaedist)

By prescribing Orthopaedist's requesting behaviour, Radiologists became much more autonomous to carry out their clinical tasks. In the past they would need to check if Orthopaedists followed the protocol when requesting X-Ray test:

> 'Lots of clinicians don't fill that in and it's left to us to deal with when they get it…'. (Radiologist)

In contrast to this, AlphaSoft was designed with certain in-built flaws that led to incomplete information. This opened up a window of opportunity for nurses to exercise their discretion and 'work around' the system. For instance, a ward matron argued that AlphaSoft did not provide an exhaustive list of allergies. She said that an allergy to a medication could be broken down to allergies to more specific ingredients of that medication. The system however did not provide this level of detail to nurses, but the nurses relied on their own expertise. If a nurse needed to update a patient record or send out a test or process a medical prescription, she would be unable to complete the task, unless she first completed the information on allergies. More importantly, because the input of wrong information could give rise to clinical risks, possibly detrimental, the matron acknowledged that many nurses were reluctant to use

the system. Furthermore, the new system increased the workload of nurses. Nurses in the Orthopaedic department were asked to scan new referrals and feed them into AlphaSoft. Because the system did not allow scanning *en masse* nurses had to do this individually, taking a considerable amount of time (between 15 to 20 minutes) away from other duties. The nurses' range of tasks were also enlarged, since they had to upload pre- and post-operative score assessments into the system, which were previously completed on paper form by the patients themselves.

AlphaSoft eliminated some of the tasks that nurses had to undertake and maintained others. For instance, due to the implementation of AlphaSoft nurses stopped spending time chasing whether a paper order has been dispatched to Radiology or not. This was because AlphaSoft enabled nurses to retrieve information instantly and to have greater visibility and monitoring of patients' arrival in the clinic. A nurse explained:

> '…on AlphaSoft I can check and see whether the patient, you know, whether they've had the X-ray or not and I can keep bringing it up on the screen all the time and going back to it, you know, using both AlphaSoft and using the system to get the X-ray back, I can play with it at all times'. (Nurse)

Yet, the use of computers has been added to nurses' daily tasks and thus not all of them felt comfortable in using AlphaSoft. Nurses would typically report throughout the study their concerns about technology, how this created a fear of changing work practices, and the uncertainty of substituting paper for computerised systems.

Further, a healthcare professional from the Radiology department argued that AlphaSoft's standardization did not lead to simplification of work processes, but to their digitalisation by transforming all paper documents into digital documents:

> '…they don't change what they do, they simply take the existing process and don't re-examine it and computerise it and I think that's a fundamental mistake' (Radiologist).

The system also influenced the work process of Radiologists who would receive complete and legible electronic orders that presented information in a standard format. This meant that they did not have to interpret bad handwriting, and thus, that they ran fewer risks of making mistakes. Also, electronic requests implied fewer transcription and data entry costs when data was transferred from the card into the Radiology's information system. In addition, AlphaSoft had the potential to create time-efficiencies by allowing the electronic dispatch of results. At the same time, the introduction of AlphaSoft had taken some tasks away from Radiologists. For instance, in the paper system they would scan the order request card, read and add extra pieces of information; in the new system, however, orders did not allow the addition of extra information.

Standardization, task discretion and autonomy in SouthTrust

For some interviewees in SouthTrust the NHS CRS was perceived as being a technology that would join-up local and national processes of healthcare delivery. They perceived it as a national infrastructure that would standardize patient records in electronic format, but also allow enough flexibility to interact with local systems that provided detailed information about episodes of care:

> '…we understood there would be a National Care Record Service which local care records systems would link into, so there would be your national patient information and then locally we would capture the details of all the episodes of care that happened at a local level.' (Programme Manager).

The release of BetaSoft that the Trust was implementing was described as being 'far from fantastically good' by the programme manager. When it was put into use, it created a number of problems to users. BetaSoft (Release 0) was described by the programme manager as being 'a very windy, clunky system' that demanded the completion of a great number of screens before any action could be taken. According to a consultant it required 27 mouse clicks to book an appointment, a minute to log into the system and a minute-and-a-half to retrieve a patient list from the system. This led to increased downtime for task completion.

Also, the system standardized and limited task discretion in a number of ways. For instance, the system did not allow users to delete previously typed information. As a result, documents and forms would keep track of all changes being made to a document, rendering it difficult for healthcare professionals to find the right information in a timely manner:

> 'The information that it put onto the sheet of paper (discharge summaries) was impenetrably difficult for people to understand and didn't allow for any localised changes… If you wrote down myocardium infarction and then you decided before the patient went home in fact it wasn't. It would say myocardium infarction and only at the bottom it would say, actually, it wasn't. It required the most ridiculous thing.' (Clinical Lead).

Also, BetaSoft R.0 was designed in such a way that clinical information had to be captured in a sequential and highly standardized way. The system assumed that all clinical information is captured once and that clinical tasks are sequential and successive. Clinical reality however was much more messy than the assumptions prescribed in the technology. Clinicians for example argued that often patients could be discharged without the system holding complete information about their admission. In reality, information is often added retrospectively, particularly during handovers. This discrepancy between how clinical work operates in practice and the assumptions about clinical work which are embodied into the technology opened up possibilities for missing information (when not entered on time and in full) and discouraged healthcare professionals for inputting information in general:

> '…you had to enter the data in a sequential way for it to work. If you make a mistake, the whole thing gets messed up. That was very evident particularly over the handover period that we were putting information into an episode in different sequences. If you didn't have the patient admitted before you discharged them. They were all these sorts of issues that actually caused problems…' (Director of clinical services).

This meant that healthcare professionals enjoyed little task discretion, as they had to enter information at the right time before proceeding into any clinical or administrative episode:

> '…as it is a live time system, if you didn't put the information in at the right time, it could cause a problem. Whereas with (name of the previous system) if you hadn't admitted somebody, somebody else could do things retrospectively, et cetera' (Director of clinical services).

This new way of working meant that users would need to spend, as the programme manager said, 'more live time' and healthcare professionals in particular become more responsible for inputting clinical information, a task that was previously undertaken by administrative staff. This indicates an enlargement of tasks for healthcare professionals, while tasks were removed from administrative staff. Further, the system would often truncate the text clinicians wrote and in doing so it could potentially distort diagnoses raising a number of clinical safety issues:

> 'If it said myocardium infarct suspected, it would just say myocardium infarct or myocardium infarct ruled out and it would say myocardium infarct because it only had that space. Amazingly, how could you design a clinical information system that didn't even have truncation sorted out. Just unbelievably basic' (Clinical Lead).

Also, the system mandated clinicians to justify every order and test they were ordering through the system information, which clinicians deemed to be irrelevant:

> 'You have to manually type in the reason on each of those three requests and there are a number of mandatory fields that we thought were just ridiculous, such as it was a requirement for instance that you needed to indicate when her last menstrual period was for a blood test where it was completely irrelevant, just because that was sort of built into the system. The whole process of ordering a test took between five and 10 times as long as if you did it with a paper version' (Clinical Lead).

Further, the system would report the results of tests back to the consultant under whose name the order was being made. Consequently, consultants would receive a number of emails, creating bottlenecks in the workflow process, without being able either to prioritise them or to dispatch them to the doctor who ordered them. The

system therefore did not render visible the requester of a test, but rather who could authorise it. Additionally, the system could not keep track of any actions taken by clinicians in response to electronic results from a test:

> '…the system that we have at the moment is that the paper results go to people and they don't get filed in the notes until they are signed, so we know somebody has seen that. How do we know that somebody has seen the electronic version and they said, you don't.' (Clinical Lead)

Furthermore, BetaSoft produced data that did not integrate with data produced by other computer systems. This created considerable data disintegration and limited the opportunity for thorough monitoring and auditing of clinical outputs. Finally, the system did not allow advanced searches within the Patient Administration System (PAS). As a result, it was very difficult finding a list of patients that were being treated by two or more doctors.

As the system was not supporting users' work practices, healthcare professionals produced a number of ways to "work around" BetaSoft. For instance, because BetaSoft did not allow the printing of patient lists, SouthTrust developed an internal system, which ran in parallel with BetaSoft and gave healthcare professionals information as to where patients were, the names of the consultant treating them and their health condition and allowed the generation of printouts:

> 'if you wanted to produce a list of patients that you could go and do a ward round and you couldn't print it. You would say to them, well how can we do a ward round then, because we don't have computers that we have by every bed and ones that we can carry around wirelessly throughout the hospital because the wireless network isn't good enough for that. How can we do

that?... It had to be a very long process of, I think we ended up doing screen dumps and then loading those into Word where you could then print them…' (Clinical Lead).

The Trust went live with BetaSoft for a period of about 18 months. It then decided to stop the implementation and reverted to an upgraded version of its previous system. Two reasons were given for this decision. First, the Trust merged with another hospital, which was using the same system that the Trust had before going live with BetaSoft. In this way, SouthTrust achieved better integration with an improved version of its legacy system. This was an obvious choice, as BetaSoft was not delivering the benefits it has promised to deliver and furthermore GammaCo had walked out of the process. GammaCo came out of the contract when the Trust had already progressed with the implementation of BetaSoft leaving the whole process lacking continuity. Second, the Trust was burdened with financial costs incurred as a result of implementing the NHS CRS that it could no longer sustain. The clinical lead estimated that they had to pay £1.5 million per year:

'It has cost us millions of pounds. It's brought our hospital nearly to its knees.' (Consultant Physician)

Discussion and Conclusion

The article considered the cases of two NHS trusts in the context of implementing a new information system of electronic patient records (EPR) as a part of the National Programme for Information Technology (NPfIT). The two Trusts followed distinct paths with regard to the implementation of the new care record systems.

The NorthTrust, piloted the implementation of AlphaSoft in the Radiology and Orthopaedic Department and despite the problems of the software and the task re-allocation, it planned to expand it to two wards. The results were quite mixed. Some professional groups such as clinicians highlighted the cumbersomeness of the system that increased downtime for task completion. Other professional groups such as nurses emphasised the elimination of routinized tasks, such as chasing after requests, and increased ability to monitor 'what work there is, who has performed/should do what and when' (Halford et al., 2010, p.212). Eventually, the momentum was lost in NorthTrust and the NPfIT was shut down before further implementation. By contrast, the SouthTrust started very enthusiastically with the implementation of the new system to get rid of "burning platforms" but soon realised that the new system is not functioning and opted out of NPfIT altogether.

Our findings suggest that the new technologies limited the work autonomy and task discretion for both nurses and clinicians by engendering routinization, through their embodied standards. The standards that were inscribed into the technology constituted a reminder of how clinical work should be done; in this sense standards played the role of the clinical protocol (Timmermans & Berg, 1997). They were also 'scripts' constitutive of new ways of working (Akrich, 1994). Drawing on the literature on standardization in low-skill work and particularly studies that report on work in call-centres, our paper suggests that technology may attain routinization of clinical work through standards inscribed into it by defining the mode, the content and the timing of healthcare work. We have shown that the ordering of an X-Ray request or a blood test involved the completion of mandatory fields, with information that was often

perceived as being redundant by healthcare professionals. The standardization of requesting behaviour echoes the monotony and routinization of tight scripting of call-centre workers (Taylor & Bain, 2001; Taylor et al., 2002). Further, the system intervened into the content of the information that clinical work produced, for instance during diagnosis. As reported for example confusing truncation and lack or limited free text meant that clinicians' diagnosis had to be in agreement with those identified by the system. Considering the fact that decisions about diagnosis and treatment are constitutive of clinical autonomy this example suggests how much technology can restrict professional judgment and jurisdiction (Boonstra et al., 2004; Timmermans & Berg, 2003). It also affected the quality of the information healthcare professionals retrieved from the system since pre-populated data were prone to include various errors due to problems in synchronisation between different systems. Finally, repetition of tasks and short task cycle times (Taylor & Bain, 2001; Taylor et al., 2002), typically found in low-skill work, seemed to be evident in the two EPR cases. Our findings have suggested that technology intervened into the temporal aspects of healthcare work by imposing a sequential approach to how healthcare information is captured. Thus, a linear logic was imposed on the dynamic and often complicated, if not messy, clinical work (Berg, 1997; Timmermans & Berg, 2003). By intervening into the mode, content, tempo, and pace of clinical work, technology standardized and routinized significant aspects of healthcare work namely, the conduct of healthcare professionals; the delivery of healthcare as well as the interaction between healthcare professionals and patients.

The above indicates that routinization through standards embodied within the technology is not confined to the boundaries of low-skill work settings (Bain et al.,

2002) but expands to professional settings that are characterised by high-skilled work. Our study shows that technology may become a tool that circumscribes healthcare professionals' autonomy by dictating the what, how and when of their work. We are not however suggesting that control is a deterministic and essential effect of technology and neither do we wish to demonise technology. On the contrary we argue that the effects of technology are an outcome of the values and assumptions 'inscribed' into it (Akrich, 1994). The effects of technology on work autonomy are thus contingent and changeable. We also argue that we should not take professional autonomy for granted but rather examine all the minuted ways in which it is being questioned, circumscribed and renegotiated by and through information technology.

Yet, the implications of technology for professional work are not unidirectional and deterministic. Technology does not simply reduce autonomy but it also redistributes it. Our study adds to the literature that examines redistribution of work among healthcare professional groups by looking in particular into how discretion is being reallocated and negotiated among healthcare professionals through technology (Badham, 2009; Barley, 1986; Barrett et al., 2011; Vikkelsø, 2005).

Our findings suggested that specific work tasks were redistributed from Radiologists to Orthopaedists, while the EPR freed up time for nurses, moving their invisible work to clinicians. These examples of redistribution of professional discretion have two different implications (Vikkelsø, 2005). The first case of redistribution is one in which redistribution of discretion coincides with redistribution of professional power and control within two different but equally prestigious and interdependent professional groups. In this case, clinicians' power is the ability to add contextual information to a

patient case informing clinical practice respectively. The second case of redistribution of discretion between doctors and nurses suggests how EPR technology enacts the power of the medical protocol (Berg, 1997) by working as a mechanism that not only regulates and bureaucratises, but also imposes fairness, ensuring a clear division of labour between professional groups. We see this as an attempt to professionalise nurses by providing them with more opportunities to focus on patient care uninterrupted.

Barley (2009) has suggested that technology does not only standardize and automate but may also confer expertise or technical specialisation that enhances autonomy and control. Our findings suggest that this may indeed occur provided that professional groups are willing and equipped to exercise discretion. In our case, nurses were reluctant to work on patient cases in which information about allergies needed to be added, and therefore resisted using the system.

Resistance was emblematic of upholding professional power and retaining control of the duty to care for patients. Resistance was also evident when clinicians used their discretion and avoided making diagnoses on the system when the latter was not presenting medical conditions accurately. Instances of 'working around' the system were also evident when for example clinicians created an internal system to support omissions of the EPR system and to get timely information. The above examples suggest that, although limited, healthcare professionals still have some opportunities to exercise discretion over the use of technology by rejecting it altogether or 'working around' it, protecting their autonomy and recapturing the control of their work process. Discretion in the form of resistance or appropriation and enactment was

always done with reference to professional values; to the potential of technology to generate clinical risks and to commitment to patient care (Leverement et al., 1998; Mueller et al., 2008). Vikkelsø (2005) has suggested too that medical risks are produced when EPR systems fail to integrate patient information. Our case however illustrates that clinical risks may be produced due to the impossibility of an EPR to provide complete information about medical events or diagnoses. This also suggests the limits of health information technology to embody clinical expertise (Timmermans & Berg, 2003).

This study aimed to reinvigorate the debate on the tension between standardization and autonomy by examining the case of highly skilled professional groups in the healthcare workplace context. Findings from this study suggest that the implication of technology in professional work conditions, through its embodied standards, some form of routinization that constrains work autonomy. We have shown how technology prescribes the mode, the content and the temporal aspects of clinical work affecting healthcare professional conduct, delivery of care, and the relationship between healthcare professionals and patients. We argue that the concept of routinization is not restricted to certain types of work (e.g. low-skilled work) but seems to travel across contexts including high-skill professional work environments. We have also shown that the consequences of technology are neither unidirectional nor deterministic; we should rather expect redistribution of opportunities for the exertion of professional discretion across professional groups. Such redistribution should be examined in the light of the power/control effects it brings to the fore, which are in turn a result of the assumptions inscribed into the technology as it is enacted in everyday work practices. Redistribution of opportunities to exercise discretion should also be seen as a way to

establish a fairer division of labour among different professional groups and to enact the clinical protocol. Furthermore, redistribution of discretion, far from being assumed, is conditional on the ability and willingness to exercise it. In a nutshell, our study highlighted the importance of analysing the interplay between routinization and autonomy in drawing insights about the dynamics of technological change that occurs in high-skilled workplaces.

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